A Description of Hanford Samples Collected for LBNL

By

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At the direction of Phil Long (PNNL), three sediment samples were collected from the White Bluffs (Figure 1) on February 4-5, 2003 by Bruce Bjornstad. The White Bluffs represent an erosional remnant of the Pliocene-age Ringold Formation, which underlies most of the Hanford Site and is the predominant unit making up the unconfined aquifer at Hanford. Samples for LBNL were selected from surface-analog localities that are most representative of those within the 100 Areas of the Hanford Site.

Two of the three samples came from exposed Ringold Formation strata along the White Bluffs. The upper portion of the Ringold Formation was dissected by post–Ringold streams and Pleistocene ice-age floods. Ice-age flood deposits belong to the Hanford formation (informal name), which is the predominant unit within the vadose zone at the Hanford Site. One sampleof coarse-grained sediment was collected from the Hanford formation. This came from the mouth of Ringold Coulee (Figure 1), where a flood channel deeply incised into the Ringold Formation and became partially backfilled with flood deposits.

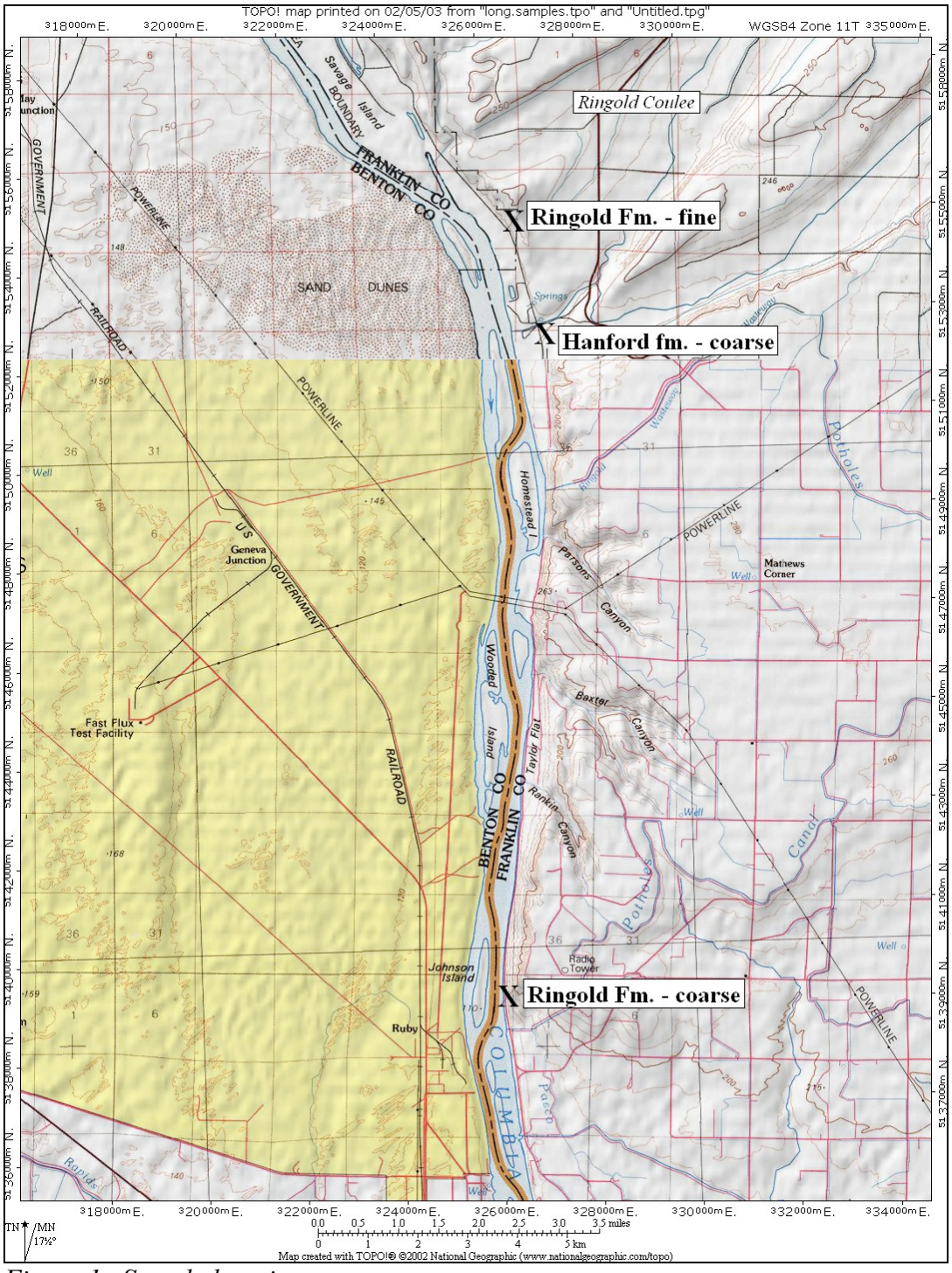

Figure 1. Sample location map.

The one sample from the Hanford formation was collected from the gravel-dominated, high-energy facies associated with ice-age flooding. The two samples from the Ringold Formation came from a lacustrine facies (Ringold Fm. – fine) and braided-stream facies (Ringold Fm. – coarse). The Ringold Fm. - fine sample is part of the Ringold member of Savage Island, which is exposed along the entire length of the bluffs. This stratigraphic

unit overlies the coarse-grained, Ringold member of Wooded Island at the southern end of the White Bluffs, which is where the Ringold Fm. – coarse sample was collected. General information for the three LBNL samples is summarized in Table 1.

Sample	Coordinates (UTM)		Elevation (ft)	Lithology	Stratigraphic Unit	Approximate Age (millions of yrs)	Shipped Weight (lbs.)
Hanford fm. - coarse	327210E	5152665N	450	Sandy pebble gravel	Hanford formation (gravel-dominated facies)	.013	32
Ringold Fm. - fine	326540E	5155040N	630	Interlaminated silt to fine sand	Ringold Formation (member of Savage Island)	~4.0	21
Ringold Fm. - coarse	326025E	5139110N	370	Sandy pebble-cobble gravel	Ringold Formation (member of Wooded Island)	~5.3	28 (after larger gravel clasts removed)

Table 1. General information for the three LBNL samples.

Detailed Sample Descriptions

Sample #1. Hanford fm. – coarse

The single sample from the Hanford formation consists of a loose, dark gray, poorly to moderately sorted, stratified, subangular to subrounded, sandy pebble gravel. The material was collected from near the base of an exposure of flood deposits at the mouth of Ringold Coulee (Figure 2). This material represents high-energy flood deposits transported off the Channeled Scabland from the northeast via Ringold Coulee (Figure 1). The sample was collected from a finer bed of mostly pebbles between beds of coarser pebble to cobble gravel (Figure 2). All the sedimentary particles were small-pebble size or smaller (Figure 3) so no separation of the sample was performed in the field. Thus the bulk weight is the same as the shipped weight in Table 1. In contrast to the quartzo-feldspathic Ringold Formation, the Hanford formation contains significantly more basalt (Figure 3) and, as a result, has a much higher bulk density.

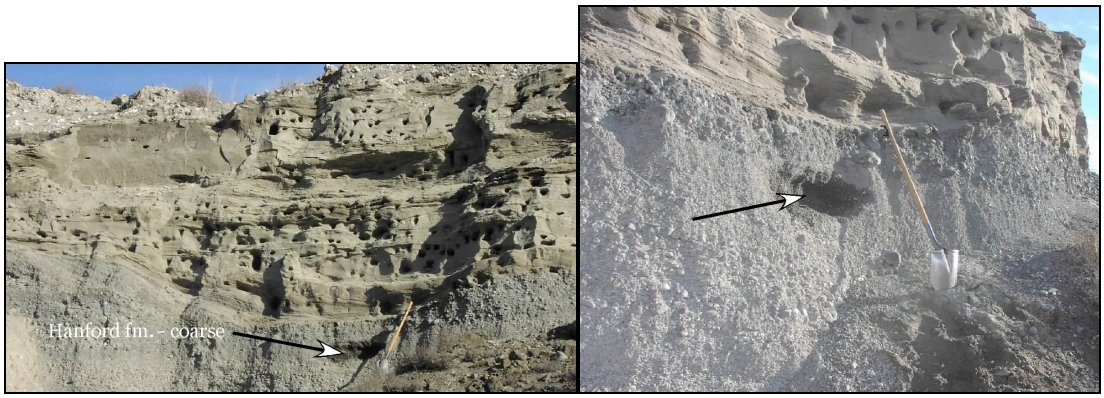

Figure 2. Location of Hanford fm. – coarse sample from the mouth of Ringold Coulee, along the White Bluffs. Arrows show exact location of sample. Shovel is 4.5 ft long.

Figure 3. Close-up of Hanford fm. – coarse sample in sample bag. Notice dark-gray color, angularity, poor sorting and basaltic composition of clasts, all characteristics of coarse-grained facies of the Hanford formation. Notice penny for scale.

Sample #2. Ringold Fm. – fine

The Ringold Fm. – fine sample was collected from a fine-grained, cliff-forming band located 200-300 feet above the road level along the White Bluffs (Figure 4). These strata are part of the Ringold member of Savage Island. Strata at this location consist of horizontally laminated, yellowish brown, interbeds and laminations of well-sorted silt- to fine-sand sized particles (Figure 5). The unit is compact and locally well indurated and cemented. The fine-grained nature and well-preserved laminations in these strata suggest they are of lacustrine origin, deposited at a time when the Pasco Basin was filled with a large, long-lived, freshwater lake.

Figure 4. Ringold Fm. – fine sample collected from the White Bluffs. Arrow in right photo shows approximate thickness range over which the sample was collected.

Figure 5. Close-up of Ringold Fm. – fine sample in outcrop (left) and in sample bag (right). Note bands of higher iron-oxide staining, characteristic of this facies of the Ringold Formation.

Sample #3. Ringold Fm. – coarse

The Ringold Fm. – coarse sample came from an exposure of the Ringold member of Wooded Island at road level along the southern end of the White Bluffs (Figure 1). The sampling location lies just south of where a debris-flow landslide blocks the road, which parallels the river (Figure 1). These strata consist of dark yellowish brown, massive to weakly bedded and imbricated, clast-supported, sandy pebble-cobble gravel (Figure 6). This stratigraphic unit is bimodal having a distinct pebble-cobble fraction along with a fine- to coarse-grained sand fraction filling the matrices between gravel clasts. This unit is locally indurated.

Unlike the coarse-grained facies of the Hanford formation, coarse-grained Ringold Formation consists of mostly well-rounded and polished non-basaltic clasts of quartzite, granite, and a variety of volcanic clasts. The moderately to well sorted sandy matrix, on the other hand, consists of approximately equivalent amounts of limonitic-stained quartz and feldspar.

The bulk weight of the Ringold Fm. – coarse sample was 48 lbs. After removal of cobbles and larger pebbles from the sample, the shipped weight amounted to only 28 lbs (Table 1); thus the larger clasts amounted to about 40 wt% of the bulk sample (Figure 7).

Figure 6. Ringold Fm. – coarse sample from base of White Bluffs. Note high degree of limonitic, iron-oxide staining in matrix.

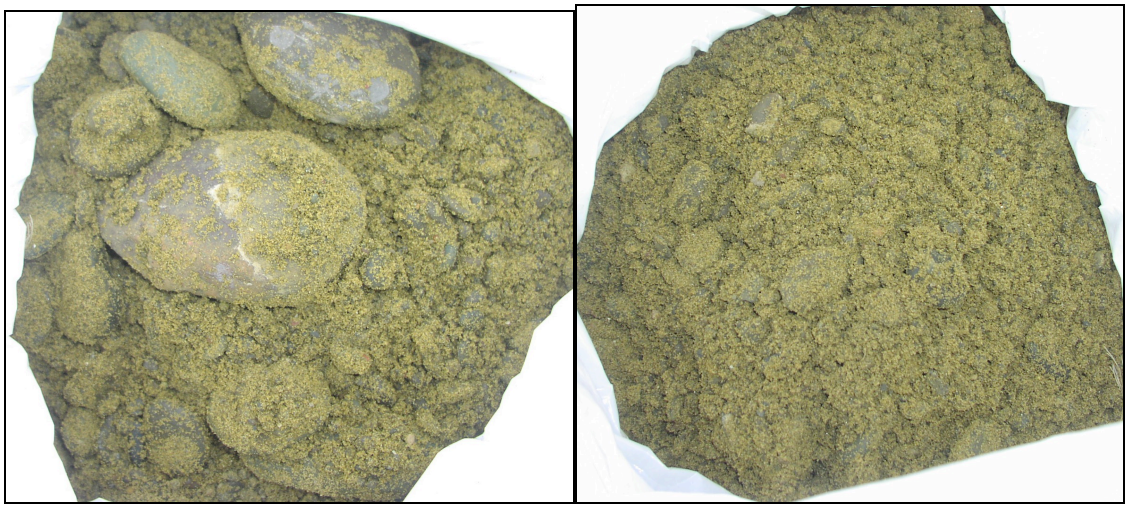

Figure 7. Close-up of Ringold Fm. – coarse sample. Left photo shows bulk sample prior to the removal of the larger clasts. Right photo shows the sample after removal of larger clasts.